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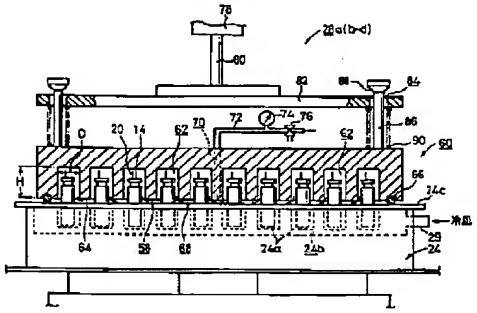
(54) METHOD AND DEVICE FOR SUPPLYING BATTERY ELECTROLYTE

(57) Abstract:

PROBLEM TO BE SOLVED: To inject the prescribed amount of an electrolyte precisely and efficiently, and to simplify the constitution.

SOLUTION: This device has a carrier 24 containing plural battery cans 14, and a decompression booth 60 having apertures 62 respectively containing the battery cans 14, and moving with respect to the carrier 24 through a cylinder 78. Further, an O-ring 66 set on an end surface 64 of the decompression booth 60 is provided to form a space 68 integrally communicating with the apertures 62 between the end surface 64 and an upper surface 24c of the carrier 24, and to keep a decompression chamber 58 composed of the apertures 62 and the space 68 airtight.



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(54)【発明の名称】　電池の電解液供給方法および装置

(57)【要約】
【課題】所定量の電解液を高精度にかつ効率的に注液するとともに、構成を簡素化することを可能にする。
【解決手段】複数の電池缶１４を収容するキャリア２４と、前記電池缶１４を一個ずつ収容する開口部６２を有し、シリンダ７８を介して前記キャリア２４に対し進退自体な減圧ブース６０と、この減圧ブース６０の端面６４に装着され、前記端面６４と前記キャリア２４の上面２４ｃとの間に前記開口部６２に一体的に連通する空間部６８を形成するとともに、この開口部６２およびこの空間部６８からなる減圧室５８を気密に保持するＯリング６６とを備える。

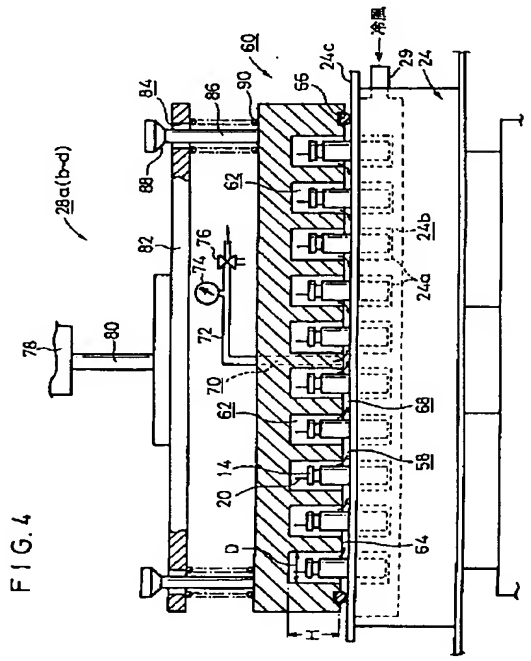

FIG.4

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【特許請求の範囲】

【請求項１】常圧下で電池缶に電解液を注液した後に減圧下で前記電解液を含浸させる処理を、複数回繰り返して該電解液の注入を行う電池の電解液供給方法であって、

前記電解液が注液された前記電池缶を減圧ブース内に配置させ、該電池缶に第１真空圧力による第１減圧処理を施した後、減圧解除処理を施す工程と、

前記電池缶に前記第１真空圧力よりも高い第２真空圧力による第２減圧処理を施した後、減圧解除処理を施す工程と、

を有することを特徴とする電池の電解液供給方法。

【請求項２】請求項１記載の電解液供給方法において、前記第１および第２減圧処理時に、前記減圧ブース内が前記第１および第２真空圧力に至った際、真空弁を介して該減圧ブース内を気密に閉塞保持することを特徴とする電池の電解液供給方法。

【請求項３】請求項１記載の電解液供給方法において、前記電池缶に前記電解液を注液するポンプの停止時間が一定時間を超えた際、前記ポンプから廃液部位に前記電解液を１ショット分だけ吐出する工程を有することを特徴とする電池の電解液供給方法。

【請求項４】請求項１記載の電解液供給方法において、複数個の前記電池缶を一体的に収容するキャリア内部に冷却風を供給して該電池缶を冷却することを特徴とする電池の電解液供給方法。

【請求項５】常圧下で電池缶に電解液を注液した後に減圧下で前記電解液を含浸させる処理を、複数回繰り返して該電解液の注入を行う電池の電解液供給装置であって、

複数個の前記電池缶を一体的に収容するキャリアと、

前記電池缶が１個ずつ受容される複数個の開口部を有し、アクチュエータを介して前記キャリアに対し進退自在な減圧ブースと、

前記減圧ブースの端面に装着され、前記端面と前記キャリアの上面との間に前記複数個の開口部に一体的に連通する空間部を形成するとともに、該複数個の開口部および前記空間部からなる減圧室を気密に保持するシール部材と、

を備えることを特徴とする電池の電解液供給装置。

【請求項６】請求項５記載の電解液供給装置において、前記減圧ブースと負圧発生源とを連通する配管途上に、該減圧ブース内を気密に閉塞保持するための真空弁が設けられることを特徴とする電池の電解液供給装置。

【請求項７】請求項５記載の電解液供給装置において、前記キャリアには、該キャリア内部に冷却風を供給して該電池缶を冷却するための冷却風供給管路が接続されることを特徴とする電池の電解液供給装置。

【請求項８】請求項５記載の電解液供給装置において、前記電池缶に前記電解液を注液する注液手段は、ポンプの停止時間が一定時間を超えた際に前記電解液を１ショット分だけ吐出する廃液部位を備えることを特徴とする電池の電解液供給装置。

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【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、常圧下で電池缶に電解液を注液した後に減圧下で前記電解液を含浸させる処理を、複数回繰り返して該電解液の注入を行う電池の電解液供給方法および装置に関する。

【０００２】

【従来の技術】一般に、電池の組立工程において、正極板と負極板がセパレータを挟んで巻回された極板群を電池缶内に収納した後、この電池缶内に電解液を注液する作業が行われている。

【０００３】この種の注液作業では、安全装置の作動性を確保するために、電池缶内の隙間を僅かにする必要がある一方、電池性能上の観点から、多量の電解液を精度よく注入しなければならない。また、電池缶内では、ビーディングにより形成された溝の上部に電解液が残存すると、この電池缶に封口体を挿入する際に前記電解液が機内に飛散するおそれがある。このため、電解液を電池缶内に十分に含浸させる必要がある。

【０００４】そこで、例えば、特開平８－２５０１０７号公報に開示されているように、カップを用いて電池缶内に電解液を一度に注入する方法が知られている（以下、従来技術１という）。この従来技術１では、電池缶の上部に設けられた開口部にカップが配置され、予めこのカップ内に電解液を供給しておき、遠心力、減圧および加圧によって前記電解液を注入したり、あるいは、予め電池缶内部を減圧しておき、バルブの切り替え作用下に、該カップ内から電解液を注入している。

【０００５】また、電解液の注液処理と含浸処理とを繰り返す方法が、従来から行われている（以下、従来技術２という）。この従来技術２は、電池缶の上縁部まで電解液を注液した後、常圧下（減圧下）でこの電解液を含浸させる工程を複数回繰り返すことにより、前記電池缶内への注液作業を行うものである。

【０００６】

【発明が解決しようとする課題】しかしながら、上記の従来技術１では、電池缶内から突出するリード（正極リード）に電解液が大量に付着し易く、このリードにレーザ溶接等によって封口体を溶接する際の支障となってしまう。このため、電解液を注入した後、リードに付着している電解液を完全に除去する装置を設ける必要があり、工程が煩雑化するとともに、設備費が高騰するという問題が指摘されている。

【０００７】しかも、電解液を一旦貯溜するカップには、この電解液内の固形分である塩が析出してしまい、電池缶内への注液量に大きなバラツキが発生してしまう。また、カップのシール部分に塩が析出すると、シー

ル性の悪化が惹起されてしまう。このため、カップを洗浄するための専用の装置が必要になり、設備全体が大がかりなものになるという問題がある。

【０００８】一方、上記の従来技術２では、常圧下における電解液の含浸処理を行う場合、この電解液の含浸に長時間を要するとともに、電池缶内部に空間が存在しているにも係わらず、空気の逃げ場がなくなり、この空間内に電解液が含浸しないという問題がある。また、減圧下における電解液の含浸処理では、電池缶内に注液された電解液の液面が上昇し、この電解液が前記電池缶の上縁部からこぼれるおそれがある。

【０００９】本発明は、この種の問題を解決するものであり、電解液を所定の量だけ正確に注液するとともに、この電解液が不要な部分に付着することを阻止し、しかも、構成を簡素化することが可能な電池の電解液供給方法および装置を提供することを目的とする。

【００１０】

【課題を解決するための手段】本発明に係る電池の電解液の供給方法および装置では、電解液が注液された電池缶を減圧ブース内に配置し、先ず、この電池缶に第１真空圧力による第１減圧処理が施された後、減圧解除処理が施される。次いで、電池缶に第１真空圧力よりも高い第２真空圧力による第２減圧処理が施された後、減圧解除処理が行われる。

【００１１】このように、第１真空圧力よりも第２真空圧力を高く設定することにより、電池缶に注液された電解液が、この電池缶の上縁部からこぼれ出すことを確実に阻止することができる。しかも、常圧下における含浸処理に比べて、含浸時間を大幅に短縮することが可能になる。

【００１２】ここで、第１および第２減圧処理時に、減圧ブース内が第１および第２真空圧力に至った際、真空弁を介して前記減圧ブース内を気密に閉塞保持している。従って、減圧時に減圧ブース内に空気の流れが発生することを確実に阻止し、電解液の蒸発を有効に抑えて注液量のバラツキが発生することがない。

【００１３】また、電池缶に電解液を注液するポンプの停止時間が一定時間を超えると、ポンプノズル部の電解液が蒸発して次の吐出量が減少し易い。例えば、電池缶内に注液される電解液の注液量のバラツキは、±５／１００ｃｃに設定されているのに対し、ポンプが１時間停止されると、ポンプノズル部の電解液が１／１００ｃｃ減少することが知られており、注液量のバラツキが相当に大きくなってしまう。そこで、ポンプの停止時間が一定時間を超えた際、このポンプから廃液部位に電解液を１ショット分だけ吐出した後、電池缶内への注液作業が行われる。このため、ポンプの電解液吐出精度を向上させることができる。

【００１４】さらにまた、複数個の電池缶を一体的に収容するキャリア内部に冷却を供給して、この電池缶を冷却している。従って、電池缶に注液された電解液が、減圧含浸時に沸騰することを阻止するとともに、この電解液の蒸発を有効に防止することが可能になる。

【００１５】

【発明の実施の形態】図１は、本発明の実施形態に係る電解液供給装置１０の概略平面説明図であり、図２は、この電解液供給装置１０の一部概略正面図である。

【００１６】電解液供給装置１０により電解液が分割注液される電池１２は、図５に示すように、有底円筒形状の電池缶１４を有し、この電池缶１４内には、正極板と負極板がセパレータを挟んで巻回された極板群１６が挿入されている。極板群１６の負極リード１８が電池缶１４の底面に溶接されており、この極板群１６の正極リード２０が前記電池缶１４から上方に突出している。

【００１７】図１に示すように、電解液供給装置１０は、電池製造ライン２２に併設されており、キャリア２４を介して矢印Ａ方向に複数個（例えば、１０個）ずつ配列され、かつ矢印Ｂ方向に複数列（例えば、４列）ずつ配置された合計４０個の電池缶１４に、電解液を所定量ずつ供給可能な第１～第４注液ステーション２６ａ～２６ｄと、前記第１～第４注液ステーション２６ａ～２６ｄの下流側に配設され、前記電池缶１４に減圧処理と減圧解除処理とを交互に複数回ずつ施す第１～第４減圧ステーション２８ａ～２８ｄとを備える。

【００１８】キャリア２４は、図５に示すように、１０個の電池缶１４を所定間隔ずつ離間して配置するための収容部２４ａを有している。収容部２４ａは略円筒状を有しており、キャリア２４の内部に形成された室２４ｂ例に突出するとともに、この室２４ｂには、図示しない冷却風供給源に連通する供給管路２９が接続されている。供給管路２９から室２４ｂ内に、例えば、５℃の冷風が供給される。

【００１９】電解液供給装置１０は、図１に示すように、第１および第２注液ステーション２６ａ、２６ｂと第１および第２減圧ステーション２８ａ、２８ｂとが矢印Ｂ１方向に指向して交互に配設される第１搬送路３０と、第３および第４注液ステーション２６ｃ、２６ｄと第３および第４減圧ステーション２８ｃ、２８ｄとが矢印Ｂ２方向に指向して交互に配設される第２搬送路３２とを備える。

【００２０】第１搬送路３０の両端には、電池缶引込ステーション３４ａとキャリア移送ステーション３５ａとが設けられるとともに、第２搬送路３２の両端には、キャリア移送ステーション３５ｂと電池缶払出ステーション３４ｂとが設けられる。キャリア移送ステーション３５ａと３５ｂおよび電池缶引込ステーション３４ａと電池缶払出ステーション３４ｂとは、それぞれ第１および第２連結路３６ａ、３６ｂを介して連結され、キャリア循環搬送路が構成されている。

【００２１】第１～第４注液ステーション２６ａ～２６

ｄは、１０個ずつ４列（合計で４０個）配列された電池缶１４に、それぞれ所定量（第１回分～第４回分）の電解液を供給可能な第１～第４注液手段３８ａ～３８ｄを備える。

【００２２】図２に示すように、第１注液手段３８ａは、キャリア２４の長手方向（矢印Ａ方向）両端側上方に互いに平行して配設されたレール４０ａ、４０ｂに沿って矢印Ｂ方向に進退自在な自走式移動本体４２ａ、４２ｂを備える。移動本体４２ａ、４２ｂには、図示しない昇降手段を介してアーム４４の両端が支持されるとともに、このアーム４４には、キャリア２４に載置された１０個の電池缶１４に対応して定量ポンプ４６ａ～４６ｊが装着される。定量ポンプ４６ａ～４６ｊは、電解液が貯溜された液タンク４８に連通しており、各定量ポンプ４６ａ～４６ｊには、下方に向かって注液管５０ａ～５０ｊが配置されている。

【００２３】図３に示すように、第１注液手段３８ａには、定量ポンプ４６ａ～４６ｊの停止時間が一定時間を超えた際、電解液を１ショット分だけ吐出するための空打ちステーション５２が設けられる。この空打ちステーション５２は、第１注液手段３８ａによる電池缶１４への電解液の注液位置の外方に配置される廃液トレイ５４を備え、この廃液トレイ５４に接続される廃液管５６が、図示ない廃液タンク等に接続されている。

【００２４】第１注液ステーション２６ａの下流側に配置された第１減圧ステーション２８ａは、図４に示すように、４列に配置された各キャリア２４の全体を覆って、あるいは、各列の前記キャリア２４毎に減圧室５８を形成するための昇降自在な減圧ブース６０を備える。

【００２５】減圧ブース６０は、所定数の電池缶１４に対応して、各電池缶１４を１個ずつ受容する開口部６２を有し、各開口部６２は、前記減圧ブース６０の端面６４側から所定の深さＨまで形成されるとともに、直径Ｄが設定された開口断面円柱状を有している。深さＨは、各電池缶１４の上部側から突出する正極リード２０を避け得る必要最小限の深さに設定される一方、直径Ｄは、この電池缶１４の直径よりもわずかに大径に設定されている。

【００２６】減圧ブース６０の端面６４には、全ての開口部６２を囲繞してＯリング（シール材）６６が装着される。Ｏリング６６は、キャリア２４の上面２４ｃに密着し、減圧ブース６０の端面６４と前記上面２４ｃとの間に各開口部６２に一体的に連通する空間部６８を形成する。開口部６２と空間部６８とから減圧室５８が構成され、この減圧室５８がＯリング６６により気密に保持される。

【００２７】減圧ブース６０には、空間部６８に連通する通路７０が形成され、この通路７０と図示しない負圧圧発生源とを連通する配管７２の途上には、圧力計７４および真空弁７６が設けられる。この真空弁７６は、通路７０を図示しない負圧発生源に連通させるポジションと、前記通路７０を大気に開放されるポジションと、前記通路７０を閉塞するポジションとに切り替えられる。

【００２８】減圧ブース６０を昇降させるためのアクチュエータ、例えば、シリンダ７８から下方に延在するロッド８０には支持板８２が固着され、この支持板８２の四隅に孔部８４が形成される。減圧ブース６０の上部に支柱８６が固着され、この支柱８６が孔部８４よりも小径に設定されるとともに、各支柱８６の上部には上方には向かって拡径するセンタリング用テーパ面８８が形成される。支柱８６にスプリング９０が外挿され、このスプリング９０の両端が減圧ブース６０と支持板８２とに押し付けられている。

【００２９】第２～第４注液ステーション２６ｂ～２６ｄおよび第２～第４減圧ステーション２８ｂ～２８ｄは、上述した第１注液ステーション２６ａおよび第１減圧ステーション２８ａと同様に構成されており、同一の構成要素には同一の参照符号を付してその詳細な説明は省略する。

【００３０】このように構成される本実施形態に係る電解液供給装置１０の動作について、本発明に係る電解液供給方法との関連で以下に説明する。

【００３１】図１に示すように、電池缶１４が、電池製造ライン２２に沿って矢印Ａ１方向に搬送され、所定数（１０個）の電池缶１４が電池缶引込ステーション３４ａに配置されているキャリア２４の収容部２４ａに挿入支持される。電池缶引込ステーション３４ａでは、各キャリア２４に電池缶１４がそれぞれ１０個ずつ配置された後、４列のキャリア２４が第１注液ステーション２６ａに搬送される。

【００３２】第１注液ステーション２６ａでは、先ず、第１注液手段３８ａが１列目のキャリア２４に対応して配置されており、アーム４４が、図２中、矢印Ｃ１方向（鉛直下方向）に移動する。そして、各定量ポンプ４６ａ～４６ｊに設けられている注液管５０ａ～５０ｊが、１列目のキャリア２４に支持されている各電池缶１４の上部に配置された後、前記定量ポンプ４６ａ～４６ｊが駆動される。このため、定量ポンプ４６ａ～４６ｊは、液タンク４８内に貯溜されている電解液を所定の量（第１回分）だけ各注液管５０ａ～５０ｊを介して電池缶１４内に注入する。

【００３３】次いで、アーム４４が上昇（矢印Ｃ２方向）するとともに、移動本体４２ａ、４２ｂがレール４０ａ、４０ｂに沿って矢印Ｂ１方向（または、矢印Ｂ２方向）に所定距離だけ移動し、第１注液手段３８ａが２列目のキャリア２４の上方に対応して配置される。この状態で、１列目のキャリア２４に挿入されている電池缶１４と同様に第１注液手段３８ａが駆動され、２列目のキャリア２４に挿入されている各電池缶１４内に第１回分の電解液が注入される。同様にして、第１注液ステー

ション２６ａに配置されている３列目および４列目のキャリア２４に挿入支持されている各電池缶１４に対する第１回分の電解液の供給処理が遂行される。

【００３４】第１注液ステーション２６ａで電池缶１４に第１回分の電解液が注入された後、４列目のキャリア２４が第１減圧ステーション２８ａに一体的に送られて減圧処理が施される。すなわち、第１減圧ステーション２８ａでは、図４に示すように、シリンダ７８の作用下に、ロッド８０が下方向に移動すると、このロッド８０に固着された支持板８２が下降し、前記支持板８２にテーパ面８８を介してセンタリング支持されている減圧ブース６０が下降する。このため、減圧ブース６０の端面６４に装着されているＯリング６６がキャリア２４の上面２４ｃに密着し、前記キャリア２４に収容されている電池缶１４が減圧室５８内に一体的に配置される。

【００３５】この状態で、真空弁７６を介して減圧ブース６０の通路７０が図示しない負圧発生源に連通し、この負圧発生源の作用下に、前記通路７０を介して減圧室５８内が減圧される。ここで、図６に示すように、減圧室５８内が、－２００ｍｍＨｇの減圧度（第１真空圧力）状態に至ると、真空弁７６が閉じられてこの減圧室５８が気密に閉塞保持される。そして、減圧室５８内を約１０秒間以上、－２００ｍｍＨｇの減圧状態に放置した後、真空弁７６を切り替えて通路７０を大気に開放させる（減圧解除処理）。

【００３６】次に、真空弁７６が駆動されて減圧室５８が図示しない負圧発生源に連通し、この負圧発生源の作用下に、前記減圧室５８内が－７００ｍｍＨｇの減圧度（第２真空圧力）状態に至ると、前記真空弁７６が閉じられる。このため、減圧室５８内は、－７００ｍｍＨｇの減圧状態を維持し、所定時間経過後に真空弁７６が大気開放される。

【００３７】このように、第１減圧ステーション２８ａでは、電池缶１４が配置されている減圧室５８内が、先ず、第１真空圧力である－２００ｍｍＨｇの減圧度に減圧されて電解液の含浸が行われるとともに、この減圧室５８が大気に開放されて減圧解除処理が施され、電池缶１４から前記電解液がこぼれることをを阻止している。次いで、減圧室５８内は、第２の真空圧力である－７００ｍｍＨｇの減圧度に維持された後、前記減圧室５８が大気に開放される。

【００３８】このため、電池缶１４内に注入された電解液は、この電池缶１４からこぼれることがなく、しかもこの電解液を短時間で確実に含浸させることができるという効果が得られる。特に、電池缶１４内の電解液が泡状となり、この泡状電解液が正極リード２０に沿って盛り上がるようにして泡が形成されることがなく、この正極リード２０に電解液の塩が付着することを確実に阻止することが可能になる。これにより、注液処理後の正極リード２０に付着した塩を除去する作業が不要になり、注液作業全体の効率化が容易に遂行されるという効果が得られる。

【００３９】なお、－２００ｍｍＨｇの減圧含浸時には、電池缶１４内の上部空隙への電解液の含浸が行われる一方、－７００ｍｍＨｇの減圧含浸時には、前記電池缶１４内の下部空隙である極板群１６内への前記電解液の含浸が行われることになる。

【００４０】また、本実施形態では、電池缶１４を収容しているキャリヤ２４に供給管路２９が接続されており、この供給管路２９を介して前記キャリヤ２４の室２４ｂに、例えば、５℃の冷風が導入される。これにより、収容部２４ａに配置されている各電池缶１４は、冷風による冷却作用が施されており、この電池缶１４内に注液される電解液の温度が高騰することを阻止している。従って、電解液の沸騰を確実に防止することが可能になるとともに、前記電解液の蒸発をも可及的に防止することができる。

【００４１】さらにまた、本実施形態では、減圧ブース６０に各電池缶１４を収容可能な最小容積の開口部６２が複数形成されており、この減圧ブース６０に装着されたＯリング６６をキャリヤ２４の上面２４ｃに密着させて、前記開口部６２および空間部６８からなる減圧室５８を気密に閉塞保持している。

【００４２】このため、減圧室５８内が第１真空圧力である－２００ｍｍＨｇに至った際に、真空弁７６を閉じることによってこの減圧室５８内が密閉状態で保持され、前記減圧室５８内の空気の流れを遮断することができ、電解液の蒸発を有効に阻止して注液量のバラツキが発生することはない。その際、減圧室５８内は、空間部６８に連通する通路７０から吸引されるため、各電池缶１４の上部側に空気の流れが惹起することがなく、例えば、電解液の液面の揺れを有効に抑えることが可能になる。

【００４３】しかも、減圧ブース６０は、支持板８２に対して支柱８６およびスプリング９０を介してフローティング支持されている。従って、キャリヤ２４の上面２４ｃに傾きが生じていても、減圧ブース６０に装着されているＯリング６６を前記上面２４ｃに対し確実に密着させ、減圧室５８内を気密に閉塞保持することができる。また、シリンダ７８を介してロッド８０が上方に移動すると、支持板８２の孔部８４を構成する壁面に各支柱８６のテーパ面８８が支持され、減圧ブース６０が容易かつ自動的にセンタリングされることになる。

【００４４】第１減圧ステーション２８ａで所定の含浸処理が施された電池缶１４は、キャリア２４と一体的に第２注液ステーション２６ｂに移送される。この第２注液ステーション２６ｂでは、第１注液ステーション２６ａと同様に、４列に配置されたキャリア２４の各電池缶１４に対して第２回分の電解液の注入作業が行われる。第２注液ステーション２６ｂで第２回分の電解液の注入

が行われた電池缶１４は、第２減圧ステーション２８ｂに搬送される。

【００４５】この第２減圧ステーション２８ｂでは、図７に示すように、減圧処理と減圧解除処理とを３回ずつ行うことにより、第２回分の電解液の含浸処理が施される。具体的には、減圧ブース６０が下降することによりＯリング６６がキャリア２４の上面２４ｃに密着して減圧室５８が形成された後、先ず、－２００ｍｍＨｇの減圧度（第１真空圧力）状態で所定時間だけ放置し、大気開放を行って減圧解除処理が施される。

【００４６】次いで、減圧室５８を－４００ｍｍＨｇの減圧度（第２真空圧力）状態に減圧して所定時間だけ放置し、大気開放を行う。さらに、－７００ｍｍＨｇの減圧度（第３真空圧力）状態に減圧して所定時間だけ保持した後、減圧解除処理が行われる。

【００４７】このように、第２減圧ステーション２８ｂでは、減圧処理と減圧解除処理とが交互に行われるとともに、第１真空圧力、第２真空圧力および第３真空圧力と減圧度が、順次、高くなるように設定されている。これにより、－２００ｍｍＨｇの減圧含浸時に電池缶１４の上部空隙に含浸が行われる一方、－４００ｍｍＨｇおよび－７００ｍｍＨｇの減圧含浸時に前記電池缶１４の下部空隙への含浸が行われ、第１減圧ステーション２８ａと同様の効果が得られる。

【００４８】次に、キャリア２４は、キャリア移送ステーション３５ａに搬送され、第１連結路３６ａに沿って、図１中、矢印Ａ１方向に搬送されてキャリア移送ステーション３５ｂに送られる。キャリア２４の電池缶１４は、キャリア移送ステーション３５ｂから第３注液ステーション２６ｃおよび第３減圧ステーション２８ｃに搬送されて第３回分の電解液の注入および含浸処理が施される。電池缶１４は、さらに第４注液ステーション２６ｄおよび第４減圧ステーション２８ｄに搬送されて第４回分の電解液の注液および含浸処理が行われ、電池缶払出ステーション３４ｂに移送される。第３および第４減圧ステーション２８ｃ、２８ｄでは、第２減圧ステーション２８ｂと同様に、図７に示す手順により電解液の含浸処理が施される。

【００４９】この電池缶払出ステーション３４ｂでは、各キャリア２４に挿入支持されている電池缶１４が電池製造ライン２２に、順次、送り出される。電池缶１４は、矢印Ａ１方向に搬送されて封口処理等の次段の工程に送られる。

【００５０】ところで、第１乃至第４注液ステーション２６ａ～２６ｄでは、定量ポンプ４６ａ～４６ｊを介して電池缶１４内に電解液が一定量ずつ吐出されており、この定量ポンプ４６ａ～４６ｊが一定時間以上停止すると、それぞれのポンプノズル部の電解液が蒸発してしまう。

【００５１】そこで、本実施形態では、定量ポンプ４６ａ～４６ｊの停止時間が一定時間を超えた際、図３に示すように、前記定量ポンプ４６ａ～４６ｊが空打ちステーション５２に一旦移送される。この空打ちステーション５２では、定量ポンプ４６ａ～４６ｊから廃液トレー５４に１ショット分の電解液が吐出された後、前記定量ポンプ４６ａ～４６ｊが注液位置まで移動して電池缶１４内への電解液の注液作業が行われる。

【００５２】このように、定量ポンプ４６ａ～４６ｊが一定時間以上、例えば、５分間以上停止すると、空打ちステーション５２に移送されて空打ちが行われる。このため、電池缶１４には、常時、所定量の電解液が高精度に注液され、注液量のバラツキを有効に阻止することができるという効果が得られる。

【００５３】なお、本実施形態を用いて実際に注液を行ったところ、２秒タクトでかつ電池缶１４内の空隙が０．８～１．０ｃｃの条件下において、注液量のバラツキが±０．０５ｃｃの範囲内となり、電解液の飛散がなく、しかも正極リード２０の汚れもない、良好な注液処理が達成された。

【００５４】

【発明の効果】以上のように、本発明に係る電池の電解液供給方法および装置では、電池缶に電解液が注液された後、この電池缶に、先ず、第１真空圧力による第１減圧処理と減圧解除処理とが施される。次いで、電池缶には、第１真空圧力よりも高い第２真空圧力による第２減圧処理および減圧解除処理が施される。このため、電解液の液面が必要以上に上昇してこぼれ等が発生することがなく、しかも電解液の含浸処理が短時間で効率的に遂行される。さらに、極板等に電解液が付着することがなく、電解液供給作業全体の効率化が容易に遂行される。

【図面の簡単な説明】

【図１】本発明の実施形態に係る電解液供給装置の概略平面説明図である。

【図２】前記電解液供給装置を構成する注液ステーションの一部概略正面図である。

【図３】前記注液ステーションの一部概略側面図である。

【図４】前記電解液供給装置を構成する減圧ブースの正面説明図である。

【図５】前記電解液供給装置により電解液が注液される電池缶およびキャリアの一部断面斜視図である。

【図６】第１減圧ステーションの減圧および減圧解除処理の説明図である。

【図７】第２乃至第４減圧ステーションでの減圧および減圧解除処理の説明図である。

【符号の説明】

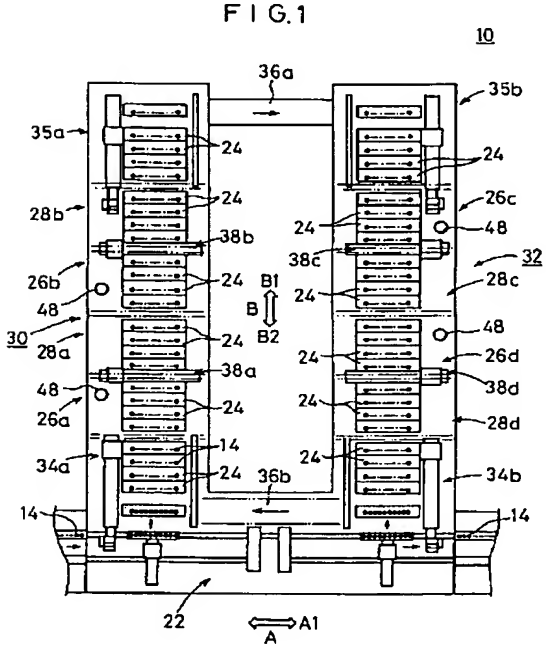
１０…電解液供給装置　１２…電池
１４…電池缶　１６…極板群
１８…負極リード　２０…正極リード

11　　12

２２…電池製造ライン　２４…キャリア　＊５４…廃液トレイ　５８…減圧室
２４ａ…収容部　２４ｂ…室　６０…減圧ブース　６２…開口部
２６ａ～２６ｄ…注液ステーション　２８ａ～２８ｄ　６４…端面　６６…Ｏリング
…減圧ステーション　６８…空間部
２９…供給管路　３８ａ～３８ｄ　７２…配管　７６…真空弁
…注液手段　７８…シリンダ　８２…支持板
４６ａ～４６ｊ…定量ポンプ　５２…空打ちス　＊　８６…支柱　８８…テーパ面
テーション　９０…スプリング

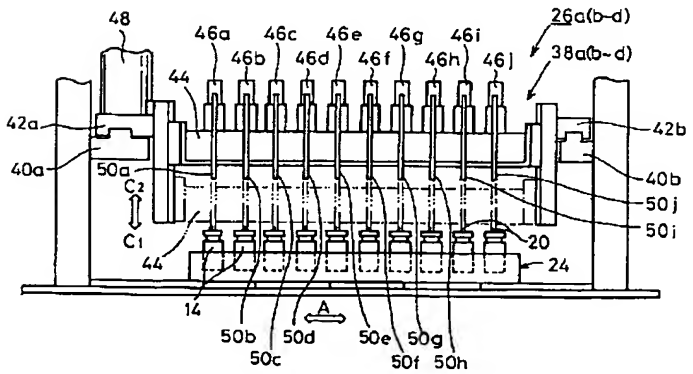
【図１】

FIG.1



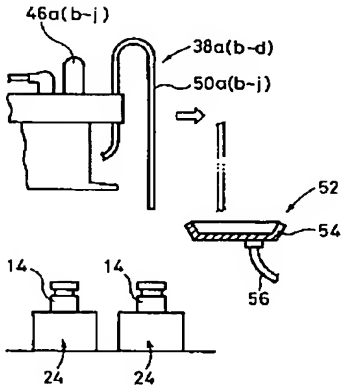
【図２】

FIG.2



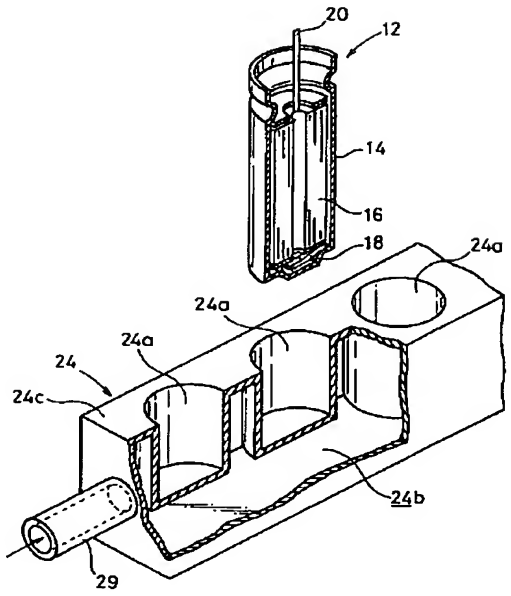
【図３】

FIG.3



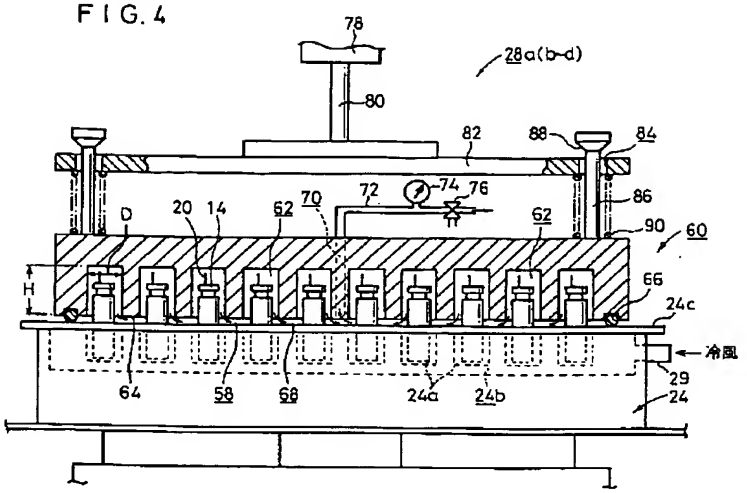
【図５】

FIG.5



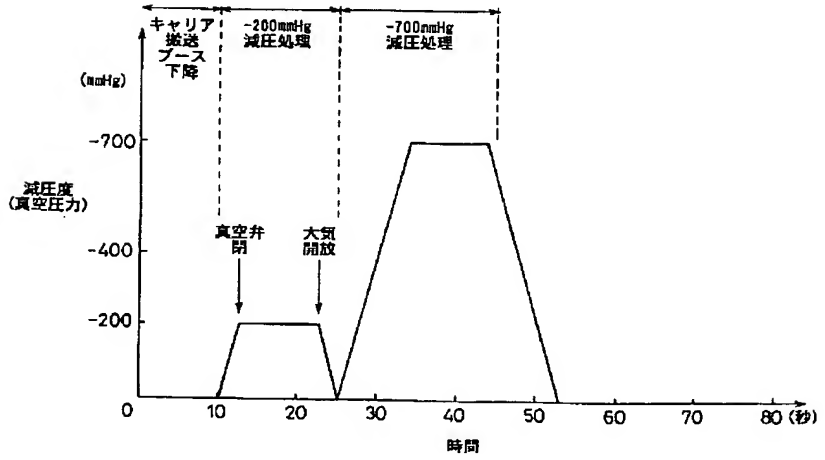
【図４】

FIG.4



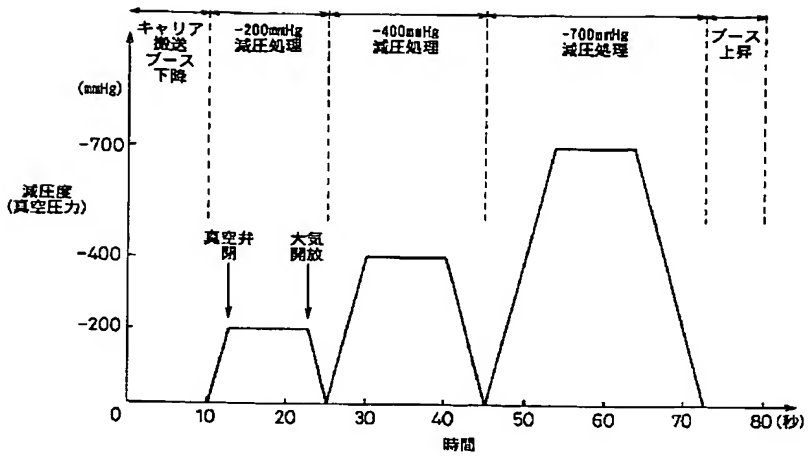
【図６】

FIG.6



【図７】

FIG.7


キャリア
搬送
ブース
下降
-200mmHg
減圧処理
-400mmHg
減圧処理
-700mmHg
減圧処理
ブース
上昇
(mmHg)
-700
減圧度
(真空圧力)
-400
-200
0
真空弁
閉
大気
開放
10
20
30
40
50
60
70
80(秒)
時間

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(54) **METHOD AND DEVICE FOR SUPPLYING BATTERY ELECTROLYTE**

(57)Abstract:
PROBLEM TO BE SOLVED: To inject the prescribed amount of an electrolyte precisely and efficiently, and to simplify the constitution.
SOLUTION: This device has a carrier 24 containing plural battery cans 14, and a decompression booth 60 having apertures 62 respectively containing the battery cans 14, and moving with respect to the carrier 24 through a cylinder 78. Further, an O-ring 66 set on an end surface 64 of the decompression booth 60 is provided to form a space 68 integrally communicating with the apertures 62 between the end surface 64 and an upper surface 24c of the carrier 24, and to keep a decompression chamber 58 composed of the apertures 62 and the space 68 airtight.

CLAIMS

[Claim(s)]

[Claim 1]The processing into which said electrolytic solution is infiltrated under reduced pressure after pouring the electrolytic solution in a cell can under ordinary pressureThe process which performs reduced pressure discharge processing after arranging said cell can with which it is the electrolytic-solution supply approach of a cell of pouring in this electrolytic solution repeatedly two or more times, and said electrolytic solution was poured in in a reduced pressure booth and performing the 1st reduced pressure processing by the 1st vaccum pressure to this cell can, The electrolytic-solution supply approach of the cell characterized by having the process which performs reduced pressure discharge processing after performing the 2nd reduced pressure processing by the 2nd vaccum pressure higher than said 1st vaccum pressure to said cell can.

[Claim 2]The electrolytic-solution supply approach of the cell characterized by carrying out lock out maintenance of the inside of this reduced pressure booth airtightly through a vacuum valve in the electrolytic-solution supply approach according to claim 1 when the inside of said reduced pressure booth results at said 1st and 2nd vaccum pressure at the time of said 1st and 2nd reduced pressure processing.

[Claim 3]The electrolytic-solution supply approach of the cell characterized by having the process which carries out the regurgitation of said electrolytic solution to a waste fluid part by one shot from said pump when the stop time of the pump which pours said electrolytic solution in said cell can exceeds fixed time amount in the electrolytic-solution supply approach according to claim 1.

[Claim 4]The electrolytic-solution supply approach of the cell characterized by supplying a cooling wind to the interior of the carrier which holds said two or more cell cans in one in the electrolytic-solution supply approach according to claim 1, and cooling this cell can.

[Claim 5]The carrier which is the electrolytic-solution feeder of the cell which repeats the processing into which said electrolytic solution is infiltrated under reduced pressure after pouring the electrolytic solution in a cell can under ordinary pressure two or more times, and pours in this electrolytic solution, and holds said two or more cell cans in one, It has two or more openings by which said one cell can is received at a time, and said carrier is received through an actuator. The reduced pressure booth which can move freely, While the end face of said reduced pressure booth is equipped and forming the space section which is open for free passage in one to said two or more openings between said end faces and top faces of said carrierThe electrolytic-solution feeder of the cell characterized by having the seal member which holds airtightly the decompression chamber which consists of these two or more openings and said space section.

[Claim 6]The electrolytic-solution feeder of the cell characterized by preparing the vacuum valve for carrying out lock out maintenance of the inside of this reduced pressure booth airtightly in the piping way which opens said reduced pressure booth and negative pressure generation source for free passage in an electrolytic-solution feeder according to claim 5.

[Claim 7]The electrolytic-solution feeder of the cell characterized by connecting the supply line of the cooling style for supplying a cooling wind to the interior of this carrier, and cooling this cell can to said carrier in an electrolytic-solution feeder according to claim 5.

[Claim 8]A pouring-in means to pour said electrolytic solution in said cell can in an electrolytic-solution feeder according to claim 5 is the electrolytic-solution feeder of the cell characterized by having the waste fluid part which carries out the regurgitation of said electrolytic solution by one

shot when the stop time of a pump exceeds fixed time amount.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the electrolytic-solution supply approach and equipment of a cell which repeat the processing into which said electrolytic solution is infiltrated under reduced pressure after pouring the electrolytic solution in a cell can under ordinary pressure two or more times, and pour in this electrolytic solution.
[0002]
[Description of the Prior Art]Generally, it sets like the erector of a cell, and after containing the group of electrode around which the positive-electrode plate and the negative-electrode plate were wound on both sides of the separator in a cell can, the activity which pours in the electrolytic solution in this cell can is done.
[0003]In this kind of pouring-in activity, in order to secure the actuation nature of a safety device, while it is necessary to make the clearance in a cell can small, a lot of electrolytic solutions must be poured in with a sufficient precision from a viewpoint on the cell engine performance. Moreover, within a cell can, when the electrolytic solution remains in the upper part of the slot formed of beading, in case an obturation object is inserted in this cell can, there is a possibility that said electrolytic solution may disperse in the inside of a plane. For this reason, it is necessary to fully infiltrate the electrolytic solution into a cell can.
[0004]The method of pouring in the electrolytic solution at once into a cell can using a cup is learned there as indicated by JP,8-250107,A (henceforth the conventional technique 1). With this conventional technique 1, a cup is arranged at opening prepared in the upper part of a cell can, the electrolytic solution is beforehand supplied in this cup, said electrolytic solution is poured in by the centrifugal force, reduced pressure, and pressurization, or the interior of a cell can is decompressed beforehand, and the electrolytic solution is poured into the bottom of a change operation of a bulb from the inside of this cup.

[0005]Moreover, the approach of repeating pouring-in processing and sinking-in processing of the electrolytic solution is performed from the former (henceforth the conventional technique 2). This conventional technique 2 does a pouring-in activity into said cell can by repeating the process into which this electrolytic solution is infiltrated under ordinary pressure (under reduced pressure) two or more times, after pouring in the electrolytic solution to the rising wood of a cell can.
[0006]
[Problem(s) to be Solved by the Invention]However, with the above-mentioned conventional technique 1, the electrolytic solution will tend to adhere to the lead (positive-electrode lead) which projects out of a cell can in large quantities, and it will become the trouble at the time of welding an obturation object to this lead by laser welding etc. For this reason, after pouring in the electrolytic solution, while it is necessary to form the equipment from which the electrolytic solution adhering to a lead is removed completely and a process makes it complicated, the problem that an installation cost soars is pointed out.

[0007]And in the cup which once stores the electrolytic solution, the salt which is the solid content in this electrolytic solution will deposit, and big variation will occur in it at the amount of pouring in into a cell can. Moreover, if a salt deposits into the seal part of a cup, aggravation of seal nature will be caused. For this reason, the equipment of the dedication for washing a cup is

needed, and there is a problem that the whole facility will become large-scale.

[0008]On the other hand, with the above-mentioned conventional technique 2, although space exists in the interior of a cell can while sinking [of this electrolytic solution] in takes long duration when performing sinking-in processing of the electrolytic solution under ordinary pressure, the refuge of air is lost and there is a problem that the electrolytic solution does not sink in into this space. Moreover, in sinking-in processing of the electrolytic solution under reduced pressure, the oil level of the electrolytic solution poured in in the cell can goes up, and there is a possibility that this electrolytic solution may fall from the rising wood of said cell can.

[0009]This invention prevents that this electrolytic solution adheres to an unnecessary part, and aims at moreover offering the electrolytic-solution supply approach and equipment of the cell which can simplify a configuration while this kind of problem is solved and only a predetermined amount pours in the electrolytic solution correctly.

[0010]

[Means for Solving the Problem]With the supply approach of the electrolytic solution of a cell and equipment concerning this invention, the cell can with which the electrolytic solution was poured in is arranged in a reduced pressure booth, and first, after the 1st reduced pressure processing by the 1st vaccum pressure is performed to this cell can, reduced pressure discharge processing is performed. Subsequently, after the 2nd reduced pressure processing by the 2nd vaccum pressure higher than the 1st vaccum pressure is performed to a cell can, reduced pressure discharge processing is performed.

[0011]Thus, the electrolytic solution poured in the cell can can prevent certainly beginning to fall from the rising wood of this cell can by setting up the 2nd vaccum pressure highly rather than the 1st vaccum pressure. And compared with the sinking-in processing under ordinary pressure, it becomes possible to shorten sinking-in time amount sharply.

[0012]Here, at the time of the 1st and 2nd reduced pressure processing, when the inside of a reduced pressure booth results in the 1st and 2nd vaccum pressure, lock out maintenance of the inside of said reduced pressure booth is airtightly carried out through the vacuum valve. Therefore, at the time of reduced pressure, in a reduced pressure booth, it prevents certainly that the flow of air occurs, evaporation of the electrolytic solution is suppressed effectively, and the variation in the amount of pouring in does not occur.

[0013]Moreover, if the stop time of the pump which pours the electrolytic solution in a cell can exceeds fixed time amount, the electrolytic solution of the pump nozzle section will evaporate and the following discharge quantity will tend to decrease. For example, if a pump is suspended for 1 hour to the variation in the amount of pouring in of the electrolytic solution poured in in a cell can being set as **5/100 cc, it is known that the electrolytic solutions of the pump nozzle section will decrease in number by 1/100 cc, and the variation in the amount of pouring in will become large fairly. Then, when the stop time of a pump exceeds fixed time amount, after breathing out the electrolytic solution from this pump by one shot to a waste fluid part, a pouring-in activity into a cell can is done. For this reason, the electrolytic-solution regurgitation precision of a pump can be raised.

[0014]Cooling was supplied to the interior of the carrier which holds two or more cell cans in one further again, and this cell can is cooled. Therefore, while the electrolytic solution poured in the cell can prevents boiling at the time of reduced pressure sinking in, it becomes possible to prevent evaporation of this electrolytic solution effectively.

[0015]

[Embodiment of the Invention]the outline flat-surface explanatory view of the electrolytic-solution feeder 10 which drawing 1 requires for the operation gestalt of this invention -- it is -- drawing 2 -- a part of this

electrolytic-solution feeder 10 -- it is an outline front view.
[0016]The cell 12 by which division pouring in of the electrolytic solution is carried out by the electrolytic-solution feeder 10 has the closed-end cylindrical shape-like cell can 14, as shown in drawing 5, and into this cell can 14, the group of electrode 16 around which the positive-electrode plate and the negative-electrode plate were wound on both sides of the separator is inserted. The negative-electrode lead 18 of a group of electrode 16 is welded to the base of the cell can 14, and the positive-electrode lead 20 of this group of electrode 16 has projected from said cell can 14 to the upper part.
[0017]As shown in drawing 1, the electrolytic-solution feeder 10 is put side by side to the cell production line 22. More than one (for example, ten pieces) are arranged every in the direction of arrow-head A through a carrier 24. In the direction of arrow-head B, two or more trains (for example, four trains) every And the 1st - the 4th pouring-in stations 26a-26d which can specified quantity [every] supply the electrolytic solution, [arranged total a can 14 of 40 cells]It is arranged in the said stations [the 1st - 4th pouring-in stations 26a-26d] downstream, and has the 1st which performs reduced pressure processing and reduced pressure discharge processing to said cell can 14 multiple times every by turns - the 4th pressure let down station 28a-28d.
[0018]The carrier 24 has hold section 24a for estranging ten cell cans 14 predetermined spacing every, and arranging them, as shown in drawing 5. Hold section 24a has approximate circle tubed, and while projecting in the ** 24b example formed in the interior of a carrier 24, the supply line 29 which is open for free passage to the source of supply of the cooling style which is not illustrated is connected to this **24b. In ** 24b, 5-degree C cold blast is supplied from a supply line 29.
[0019]The 1st conveyance way 30 in which the 1st and 2nd pouring-in stations 26a and 26b and the 1st and 2nd pressure let downs station 28a and 28b direct in the arrow-head B1 direction, and are arranged by turns as the electrolytic-solution feeder 10 is shown in drawing 1, It has the 2nd conveyance way 32 in which the 3rd and 4th pouring-in stations 26c and 26d and the 3rd and 4th pressure let downs station 28c and 28d direct in the direction of arrow-head B-2, and are arranged by turns.
[0020]While cell can lead-in station 34a and carrier migration station 35a are prepared in the both ends of the 1st conveyance way 30, carrier migration station 35b and cell can expenditure station 34b are prepared in the both ends of the 2nd conveyance way 32. The carrier migration stations 35a and 35b and cell can lead-in station 34a, and cell can expenditure station 34b are connected through the 1st and 2nd connection ways 36a and 36b, respectively, and the carrier circulation conveyance way is constituted.
[0021]The 1st - the ten 4th pouring-in stations 26a-26d equip at a time the cell can 14 by which 4 train (they are 40 pieces in total) array was carried out with the 1st which can supply the electrolytic solution of the specified quantity (the 1st batch - the 4th batch), respectively - the 4th pouring-in means 38a-38d.

[0022]As shown in drawing 2, 1st pouring-in means 38a is equipped with the self-propelled migration bodies 42a and 42b which can move freely in the direction of arrow-head B along with the rails 40a and 40b arranged in the longitudinal direction (direction of arrow-head A) both-ends side upper part of a carrier 24 by being mutually parallel. While the both ends of an arm 44 are supported by the migration bodies 42a and 42b through the rise-and-fall means which is not illustrated, this arm 44 is equipped with metering pumps 46a-46j corresponding to ten cell cans 14 laid in the carrier 24. Metering pumps 46a-46j are open for free passage on the liquid tank 48 by which the electrolytic solution was stored, face to each metering pumps 46a-46j caudad, and filling pipes 50a-50j are arranged.
[0023]As shown in drawing 3, when the stop time of metering pumps 46a-46j exceeds fixed time amount, the ****** station 52 for carrying out the regurgitation of the electrolytic solution by one shot is established in 1st pouring-in means 38a.

This ****** station 52 is equipped with the waste fluid tray 54 arranged at a way outside the pouring-in location of the electrolytic solution to the cell can 14 by 1st pouring-in means 38a, and is connected to the waste fluid tank which does not have the waste fluid tubing 56 connected to this waste fluid tray 54 illustration.

[0024]1st pressure-let-down-station 28a arranged at the downstream of 1st pouring-in station 26a is equipped with the reduced pressure booth 60 in which the rise and fall for covering each whole carrier 24 arranged at four trains, or forming a decompression chamber 58 said every carrier 24 of each train are free as shown in drawing 4.

[0025]The reduced pressure booth 60 has the opening 62 which receives each one cell can 14 at a time corresponding to the cell can 14 of a predetermined number, and each opening 62 has the shape of an opening cross-section cylinder to which the diameter D was set while being formed from the end-face 64 side of said reduced pressure booth 60 to predetermined depth H. While depth H is set as the necessary minimum depth which can avoid the positive-electrode lead 20 which projects from the upper part side of each cell can 14, the diameter D is set as the major diameter more slightly than the diameter of this cell can 14.

[0026]All the openings 62 are surrounded in the end face 64 of the reduced pressure booth 60, and it is equipped with O ring (sealant) 66. O ring 66 is stuck to top-face 24c of a carrier 24, and forms the space section 68 which is open for free passage in one to each opening 62 between the end face 64 of the reduced pressure booth 60, and said top-face 24c. A decompression chamber 58 consists of opening 62 and the space section 68, and this decompression chamber 58 is airtightly held with O ring 66.

[0027]The path 70 which is open for free passage in the space section 68 is formed in the reduced pressure booth 60, and a pressure gage 74 and the vacuum valve 76 are formed in the way of the piping 72 which opens for free passage this path 70 and negative pressure ******** which is not illustrated. This vacuum valve 76 is changed to the position which the negative pressure generation source which does not illustrate a path 70 is made to open for free passage, the position wide opened by atmospheric air in said path 70, and the position which blockades said path 70.

[0028]A support plate 82 fixes to the actuator 80 for making it go up and down the reduced pressure booth 60, for example, the rod which extends caudad from a cylinder 78, and a pore 84 is formed in the four corners of this support plate 82. While a stanchion 86 fixes in the upper part of the reduced pressure booth 60 and this stanchion 86 is set as a minor diameter rather than a pore 84, the taper side 88 for centering whose diameter goes up and is expanded is formed in the upper part of each strut 86. A spring 90 is extrapolated by the stanchion 86 and the both ends of this spring 90 are forced on the reduced pressure booth 60 and the support plate 82.

[0029]The 2nd - the 4th pouring-in stations 26b-26d, and the 2nd - the 4th pressure let down station 28b-28d are constituted like 1st pouring-in station 26a and 1st pressure-let-down-station 28a which were mentioned above, give the same reference mark to the same component, and omit the detailed explanation.

[0030]Thus, actuation of the electrolytic-solution feeder 10 concerning this operation gestalt constituted is explained below in connection with the electrolytic-solution supply approach concerning this invention.

[0031]As shown in drawing 1, the cell can 14 is conveyed in the arrow-head A1 direction along with the cell production line 22, and insertion support of the cell can 14 of a predetermined number (ten pieces) is carried out at hold section 24a of the carrier 24 arranged at cell can lead-in station 34a. In cell can lead-in station 34a, after the cell can 14 has been arranged ten pieces at a time at each carrier 24, respectively, the carrier 24 of four trains is conveyed by 1st pouring-in station 26a.

[0032]In 1st pouring-in station 26a, first, 1st pouring-in means 38a is arranged

corresponding to the carrier 24 of eye one train, and an arm 44 moves in the arrow-head C1 direction (vertical down) among drawing 2. And after the filling pipes 50a-50j prepared in each metering pumps 46a-46j have been arranged in the upper part of each cell can 14 currently supported by the carrier 24 of eye one train, said metering pumps 46a-46j drive. For this reason, as for metering pumps 46a-46j, only a predetermined amount (the 1st batch) pours in the electrolytic solution currently stored in the liquid tank 48 into the cell can 14 through each filling pipes 50a-50j.

[0033]Subsequently, while an arm 44 goes up (arrow-head C 2-way), the migration bodies 42a and 42b move only predetermined distance in the arrow-head B1 direction (or the direction of arrow-head B-2) along with Rails 40a and 40b, and 1st pouring-in means 38a is arranged corresponding to the upper part of the carrier 24 of eye two trains. In this condition, 1st pouring-in means 38a drives like the cell can 14 inserted in the carrier 24 of eye one train, and the electrolytic solution of the 1st batch is poured in into each cell can 14 inserted in the carrier 24 of eye two trains. Similarly, the provisioning process of the electrolytic solution of the 1st batch to each cell can 14 by which insertion support is carried out is carried out by the carrier 24 of eye three trains and eye four trains arranged at 1st pouring-in station 26a.

[0034]After the electrolytic solution of the 1st batch is poured into the cell can 14 by 1st pouring-in station 26a, the carrier 24 of eye four trains is sent to 1st pressure-let-down-station 28a in one, and reduced pressure processing is performed. That is, in 1st pressure-let-down-station 28a, if a rod 80 moves downward to the bottom of an operation of a cylinder 78 as shown in drawing 4, the support plate 82 which fixed to this rod 80 will descend, and the reduced pressure booth 60 by which centering support is carried out through the taper side 88 will descend to said support plate 82. For this reason, O ring 66 with which the end face 64 of the reduced pressure booth 60 is equipped sticks to top-face 24c of a carrier 24, and the cell can 14 held in said carrier 24 is arranged in one in a decompression chamber 58.

[0035]In this condition, it is open for free passage to the negative pressure generation source which the path 70 of the reduced pressure booth 60 does not illustrate through the vacuum valve 76, and the inside of a decompression chamber 58 is decompressed through said path 70 under an operation of this negative pressure generation source. Here, if the inside of a decompression chamber 58 results in a condition whenever [reduced pressure / of -200mmHg] (the 1st vaccum pressure) as shown in drawing 6, the vacuum valve 76 will be closed and lock out maintenance of this decompression chamber 58 will be carried out airtightly. And after leaving the inside of a decompression chamber 58 in the reduced pressure condition of -200mmHg more than for about 10 seconds, the vacuum valve 76 is changed and atmospheric air is made to open a path 70 wide (reduced pressure discharge processing).

[0036]Next, if it is open for free passage to the negative pressure generation source which the vacuum valve 76 drives and a decompression chamber 58 does not illustrate and the inside of said decompression chamber 58 results in a condition whenever [reduced pressure / of -700mmHg] (the 2nd vaccum pressure) under an operation of this negative pressure generation source, said vacuum valve 76 will be closed. For this reason, in a decompression chamber 58, the reduced pressure condition of -700mmHg is maintained, and atmospheric-air disconnection of the vacuum valve 76 is carried out after predetermined time progress.

[0037]Thus, in 1st pressure-let-down-station 28a, while the inside of the decompression chamber 58 where the cell can 14 is arranged is decompressed first whenever [reduced pressure / of -200mmHg which is the 1st vaccum pressure] and sinking [of the electrolytic solution] in is performed, this decompression chamber 58 was wide opened by atmospheric air, reduced pressure discharge processing was performed, and ****** in which said electrolytic solution falls from the cell can 14 is prevented. Subsequently, in a decompression chamber 58, after being maintained whenever [reduced pressure / of -700mmHg which is the 2nd

vaccum pressure], said decompression chamber 58 is wide opened by atmospheric air.

[0038]For this reason, the electrolytic solution poured in into the cell can 14 does not fall from this cell can 14, and the effectiveness that this electrolytic solution can moreover be infiltrated certainly for a short time is acquired. Especially, the electrolytic solution in the cell can 14 becomes foamy, and it becomes possible about a bubble not being formed as this foamy electrolytic solution rises in accordance with the positive-electrode lead 20, and the salt of the electrolytic solution adhering to this positive-electrode lead 20 to prevent certainly. The activity which removes the salt adhering to the positive-electrode lead 20 after pouring-in processing by this becomes unnecessary, and the effectiveness that the increase in efficiency of the whole pouring-in activity is carried out easily is acquired.

[0039]In addition, at the time of reduced pressure sinking [of -200mmHg] in, while sinking [of the electrolytic solution to the head space in the cell can 14] in is performed, at the time of reduced pressure sinking [of -700mmHg] in, sinking [of said electrolytic solution into the group of electrode 16 which is a lower opening in said cell can 14] in will be performed.

[0040]Moreover, with this operation gestalt, the supply line 29 is connected to the carrier 24 which has held the cell can 14, and 5-degree C cold blast is introduced into ** 24b of said carrier 24 through this supply line 29. Thereby, the cooling operation by cold blast is performed and each cell can 14 arranged at hold section 24a has prevented that the temperature of the electrolytic solution poured in in this cell can 14 soars. Therefore, while becoming possible to prevent ebullition of the electrolytic solution certainly, evaporation of said electrolytic solution can also be prevented as much as possible.

[0041]With this operation gestalt, two or more formation of the opening 62 of the minimum volume which can hold each cell can 14 in the reduced pressure booth 60 is carried out, O ring 66 with which this reduced pressure booth 60 was equipped is stuck to top-face 24c of a carrier 24, and lock out maintenance of the decompression chamber 58 which consists of said opening 62 and the space section 68 is carried out airtightly further again.

[0042]For this reason, when it results in -200mmHg whose inside of a decompression chamber 58 is the 1st vaccum pressure, by closing the vacuum valve 76, the inside of this decompression chamber 58 is held in the state of sealing, the flow of the air in said decompression chamber 58 can be intercepted, evaporation of the electrolytic solution is prevented effectively, and the variation in the amount of pouring in does not occur. Since it is drawn in from the path 70 which the inside of a decompression chamber 58 opens for free passage in the space section 68 in that case, it becomes possible for the flow of air not to cause in the upper part side of each cell can 14, for example, to suppress the shake of the oil level of the electrolytic solution effectively.

[0043]And floating support of the reduced pressure booth 60 is carried out through the stanchion 86 and the spring 90 to the support plate 82. Therefore, even if the inclination has arisen in top-face 24c of a carrier 24, zero ring 66 with which the reduced pressure booth 60 is equipped can be certainly stuck to said top-face 24c, and lock out maintenance of the inside of a decompression chamber 58 can be carried out airtightly. Moreover, when a rod 80 moves up through a cylinder 78, the taper side 88 of each strut 86 will be supported by the wall surface which constitutes the pore 84 of a support plate 82, and centering of the reduced pressure booth 60 will be carried out to it easily and automatically.

[0044]The cell can 14 with which sinking-in processing predetermined by 1st pressure-let-down-station 28a was performed is transported to 2nd pouring-in station 26b in one with a carrier 24. In this 2nd pouring-in station 26b, impregnation of the electrolytic solution of the 2nd batch is performed like 1st pouring-in station 26a to each cell can 14 of the carrier 24 arranged at four trains. The cell can 14 with which impregnation of the electrolytic solution of the 2nd batch was performed by 2nd pouring-in station 26b is conveyed by 2nd

pressure-let-down-station 28b.
[0045]this 2nd pressure-let-down-station 28b -- drawing 7 R> 7 -- ** -- sinking-in processing of the electrolytic solution of the 2nd batch is performed like by performing reduced pressure processing and reduced pressure discharge processing by a unit of 3 times. When the reduced pressure booth 60 descends, after O ring 66 sticks to top-face 24c of a carrier 24 and a decompression chamber 58 is specifically formed, first, only predetermined time is left in the condition whenever [reduced pressure / of -200mmHg] (the 1st vaccum pressure), atmospheric-air disconnection is performed, and reduced pressure discharge processing is performed.
[0046]Subsequently, a decompression chamber 58 is decompressed in the condition whenever [reduced pressure / of -400mmHg] (the 2nd vaccum pressure), only predetermined time is left, and atmospheric-air disconnection is performed. Furthermore, after decompressing in the condition whenever [reduced pressure / of -700mmHg] (the 3rd vaccum pressure) and holding only predetermined time, reduced pressure discharge processing is performed.
[0047]Thus, in 2nd pressure-let-down-station 28b, while reduced pressure processing and reduced pressure discharge processing are performed by turns, it is set up so that whenever [1st vaccum pressure 2nd vaccum pressure and 3rd vaccum pressure, and reduced pressure] may become high one by one. Thereby, while sinking in is performed to the head space of the cell can 14 at the time of reduced pressure sinking [of -200mmHg] in, sinking in to the lower opening of said cell can 14 is performed at the time of reduced pressure sinking [of -400mmHg and -700mmHg] in, and the same effectiveness as 1st pressure-let-down-station 28a is acquired.
[0048]Next, a carrier 24 is conveyed by carrier migration station 35a, along with 1st connection way 36a, among drawing 1, is conveyed in the arrow-head A1 direction, and is sent to carrier migration station 35b. The cell can 14 of a carrier 24 is conveyed by 3rd pouring-in station 26c and 3rd pressure-let-down-station 28c from carrier migration station 35b, and impregnation and sinking-in processing of the electrolytic solution of the 3rd batch are performed. It is further conveyed by 4th pouring-in station 26d and the 28d of the 4th pressure let down station, pouring in and sinking-in processing of the electrolytic solution of the 4th batch are performed, and the cell can 14 is transported to cell can expenditure station 34b. In the 3rd and 4th pressure let downs station 28c and 28d, sinking-in processing of the electrolytic solution is performed like 2nd pressure-let-down-station 28b by the procedure shown in drawing 7.
[0049]In this cell can expenditure station 34b, the cell can 14 by which insertion support is carried out is sent out one by one to each carrier 24 by the cell production line 22. The cell can 14 is conveyed in the arrow-head A1 direction, and is sent to the process of the next steps, such as obturation processing.
[0050]By the way, at the 1st thru/or the 4th pouring-in stations 26a-26d, if the electrolytic solution is breathed out the constant rate every in the cell can 14 through metering pumps 46a-46j and these metering pumps 46a-46j stop beyond fixed time amount, the electrolytic solution of each pump nozzle section will evaporate.
[0051]So, with this operation gestalt, when the stop time of metering pumps 46a-46j exceeds fixed time amount, as shown in drawing 3, said metering pumps 46a-46j are once transported to the ****** station 52. At this ****** station 52, after the electrolytic solution for one shot is breathed out by the waste fluid tray 54 from metering pumps 46a-46j, said metering pumps 46a-46j move to a pouring-in location, and the pouring-in activity of the electrolytic solution into the cell can 14 is done.
[0052]Thus, if metering pumps 46a-46j stop beyond fixed time amount (for example, more than for 5 minutes), it will be transported to the ****** station 52 and ****** will be performed. For this reason, the electrolytic solution of the specified quantity is always poured in the cell can 14 with high precision, and

the effectiveness that the variation in the amount of pouring in can be prevented effectively is acquired.

[0053] In addition, when actually poured in using this operation gestalt, the good pouring-in processing which the variation in the amount of pouring in becomes within the limits which is **0.05 cc, there is no scattering of the electrolytic solution, and the dirt of the positive-electrode lead 20 moreover does not have in the bottom of the condition whose opening in the cell can 14 it is a 2-second baton and is 0.8-1.0 cc, either was attained.

[0054]

[Effect of the Invention] As mentioned above, with the electrolytic-solution supply approach and equipment of a cell concerning this invention, after the electrolytic solution is poured in a cell can, the 1st reduced pressure processing and reduced pressure discharge processing by the 1st vaccum pressure are first performed to this cell can. Subsequently, the 2nd reduced pressure processing and reduced pressure discharge processing by the 2nd vaccum pressure higher than the 1st vaccum pressure are performed to a cell can. for this reason, the oil level of the electrolytic solution -- beyond the need -- going up -- falling -- etc. -- it does not generate and, moreover, sinking-in processing of the electrolytic solution is carried out efficiently for a short time. Furthermore, the electrolytic solution does not adhere to a plate etc. and the increase in efficiency of the whole electrolytic-solution supply activity is carried out easily.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline flat-surface explanatory view of the electrolytic-solution feeder concerning the operation gestalt of this invention.

[Drawing 2] a part of pouring-in station which constitutes said electrolytic-solution feeder -- it is an outline front view.

[Drawing 3] said a part of pouring-in station -- it is an outline side elevation.

[Drawing 4] It is the transverse-plane explanatory view of the reduced pressure booth which constitutes said electrolytic-solution feeder.

[Drawing 5] some of cell cans with which the electrolytic solution is poured in by said electrolytic-solution feeder, and carriers -- it is a cross-section perspective view.

[Drawing 6] It is the explanatory view of reduced pressure of the 1st pressure let down station, and reduced pressure discharge processing.

[Drawing 7] It is the explanatory view of the reduced pressure by the 2nd thru/or the 4th pressure let down station, and reduced pressure discharge processing.

[Description of Notations]

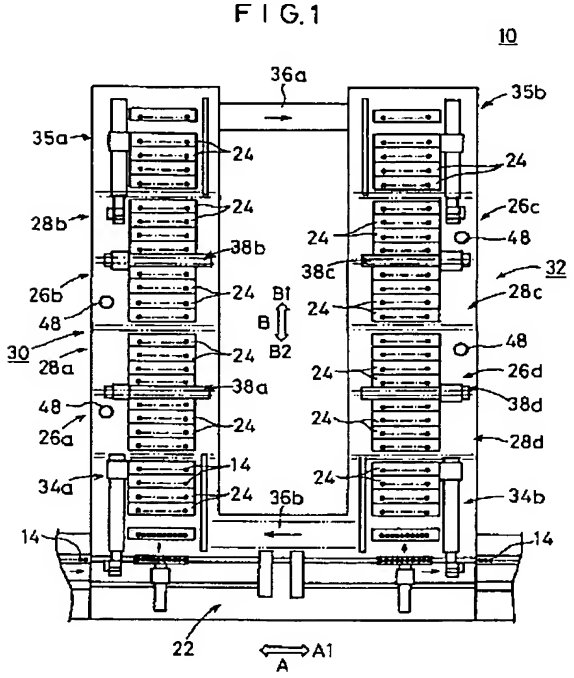
10 -- Electrolytic-solution feeder 12 -- Cell
14 -- Cell can 16 -- Group of electrode
18 -- Negative-electrode lead 20 -- Positive-electrode lead
22 -- Cell production line 24 -- Carrier
24a -- Hold section 24b -- Room
26a-26d -- Pouring-in station 28a-28d -- Pressure let down station
29 -- Supply line 38a-38d -- Pouring-in means
46a-46j -- Metering pump 52 -- ****** station
54 -- Waste fluid tray 58 -- Decompression chamber
60 -- Reduced pressure booth 62 -- Opening
64 -- End face 66 -- O ring
68 -- Space section 70 -- Path
72 -- Piping 76 -- Vacuum valve

78 -- Cylinder 82 -- Support plate
86 -- Stanchion 88 -- Taper side
90 -- Spring

DRAWINGS

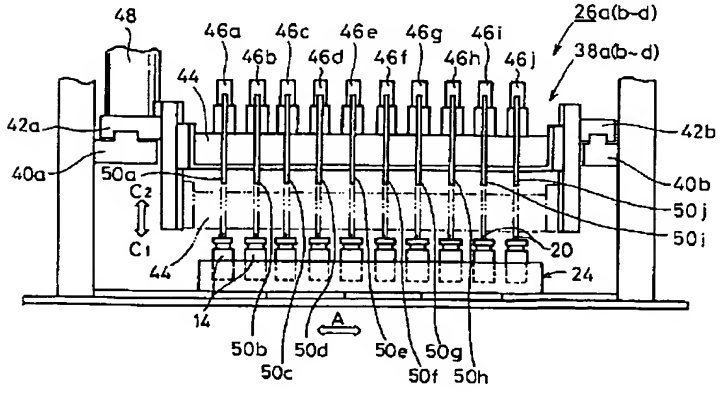
[Drawing 1]

FIG.1



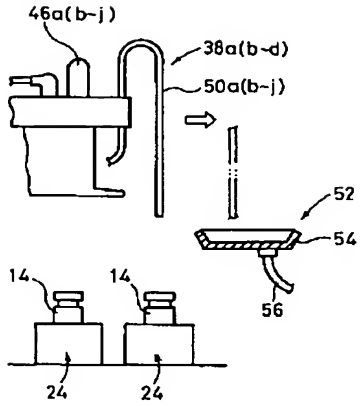
[Drawing 2]

FIG.2



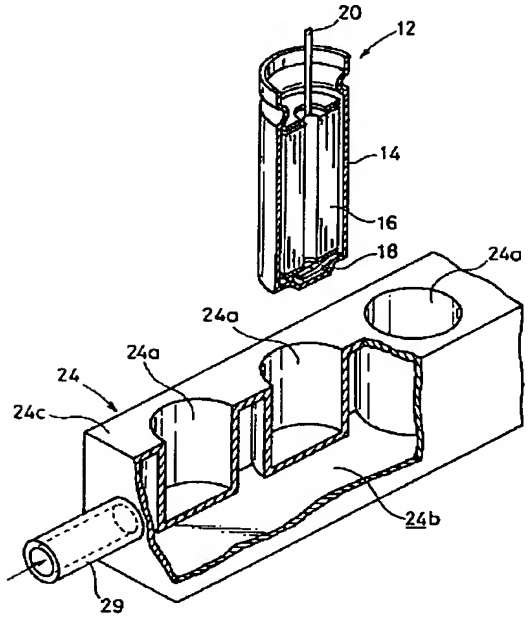
[Drawing 3]

FIG.3



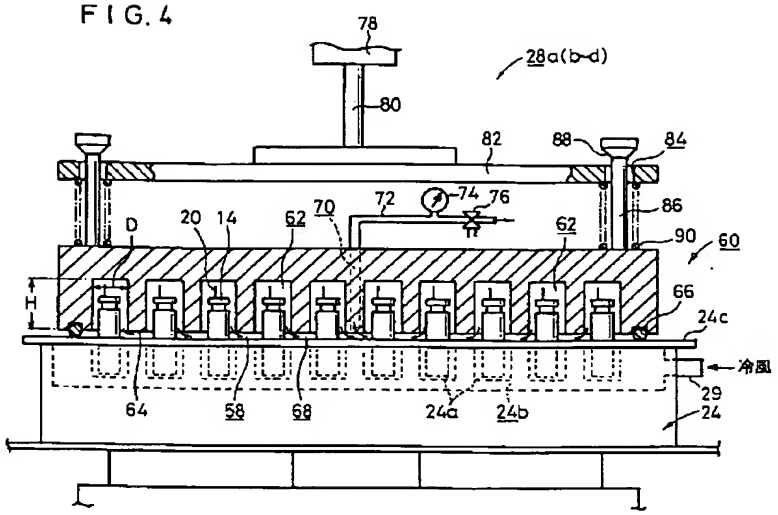
[Drawing 5]

FIG.5



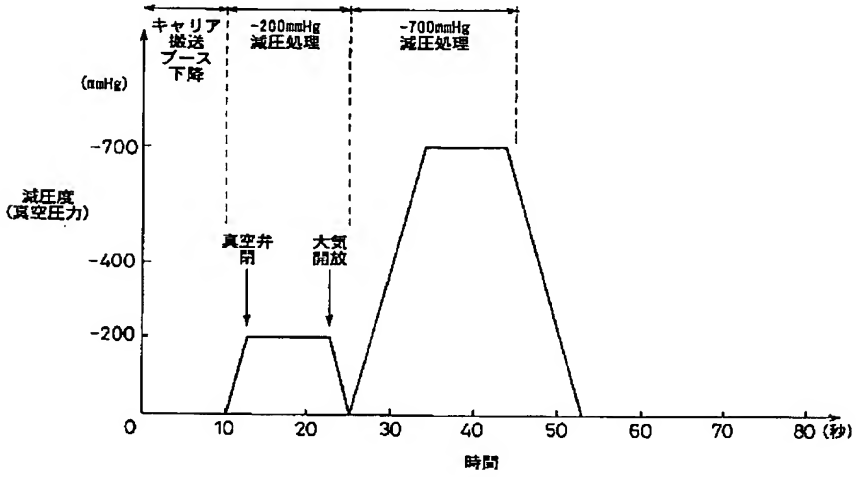
[Drawing 4]

FIG.4



[Drawing 6]

FIG.6



[Drawing 7]

FIG.7